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June 2021

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The Effect of Infographics on Developing the International Scientific Publishing Literacy among graduate students in Humanities

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The Effect of Infographics on Developing the International Scientific Publishing Literacy among graduate students in Humanities

Abstract:

Supporting scientific research and enhancing effective scholarly communication services for graduate students and academic researchers is one of the most pivotal services of the academic libraries, especially in the context of the procedures set for publishing research results in high-impact international scientific journals. On the other hand, the repercussions of Covid-19 pandemic have cast a shadow over the academic library's services, activities, and programs intended to support scholarly communication among graduate students at Imam Abdulrahman Bin Faisal University in the Kingdom of Saudi Arabia. In this context, the current study aims to measure the effect of using infographics within the Scholarly Communication Support Program with Academic Libraries in developing the international scientific publishing literacy among graduate students in humanities and the students' level of satisfaction with infographics using through a field study conducted during the academic year 2020/2021 AD. The descriptive approach was used to investigate the research problem, and a quasi-experimental approach to measure the effect on the study participants. The study population included 59 students who are enrolled in master's and doctoral studies in humanities. The study results revealed that there is a significant effect of using infographics on developing awareness of international scientific publishing issues and on achieving satisfaction with using infographics as a technology within the Scientific Communication Support Programs provided by the academic library. Finally, the research provided the results' interpretation, and a set of recommendations and suggestions that would support the activities of the academic library in raising the awareness of international scientific publishing issues among researchers.

Keywords: Visual Literacy, Digital Design, scholarly communication, scholarly publishing, Higher Education, Imam Abdulrahman bin Faisal University

1. Introduction

The international scientific publishing literacy refers to knowledge of issues relating to accessing resources and tools of publishing in scientific journals indexed in international databases, making decisions about publishing methods, choosing the appropriate outlet for publishing research results, and researchers' knowledge of their rights of self-archiving and self-publishing of their scholarly research.

Supporting research and enhancing scholarly communication services with graduate students and academic researchers is one of the most crucial services provided by the academic libraries, especially in the context of the procedures of publishing research results in high-impact international scientific journals as the activities of librarians in supporting scholarly communication have changed in recent years due to the increasingly complex nature of publishing in these journals.

Graduate students in various majors feel the necessity of publishing their academic research, but they are often unsure of how to do so. This is in part due to the apparent lack of training in the field of international publishing. For that, academic librarians can leverage their special skills to develop a specialized service that meets the students' unfulfilled needs in the campus, through a framework for information literacy in international scientific publishing (McClellan, 2017).

On the other side, Covid-19 pandemic has resulted in one of the largest disruptions in education systems throughout the history, affecting about 1.6 billion students in more than 190 countries across the five continents. The schools' universities' shutdown as well as other learning places has affected about 94% of the students worldwide, and this percentage even rises to 99% in low and middle-income countries (UNESCO, 2020). Academic libraries as the focal issue in this study are no exception, as the repercussions of the coronavirus have cast a shadow over the academic library's services, its activities, and programs of supporting scholarly communication among graduate students.

On the third side, infographics are modern technologies which refer to visual representations in which graphics (illustrations, symbols, maps, graphs, etc.) are presented in combination with verbal language (texts) for the purpose of converting data and complex concepts into pictures and drawings that can be understood easily with more clarity and appealing. The term infographics is the short form for "information graphics" which combine visual representations of data, illustrations, text, and images together in a format that is easy to understand and assimilate. Infographics are characterized by being more widespread than other electronic media through educational and entertainment social networks, newspapers, journals, and multi-interest websites. Infographics are also cost-effective, as they are a low-cost digital technology for transmitting, exchanging, and sharing information via social media or electronic mailing list. Non-profit organizations use infographics as a promotional tool to disseminate data, information, and facts about their efforts and activities thanks to their high ability to visualize complex information and facilitate its understanding (Jones et. al, 2019).

In this context, the current research aims to measure the effect of using infographics within the Scholarly Communication Support Program offered by the academic libraries on developing the international scientific publishing literacy among graduate students in humanities.

2. Problem statement and questions of the study

During the academic year 2020, the researcher conducted an exploratory study (Appendix 1) on 21 students who were enrolled in higher education programs in the humanities at Imam Abdulrahman bin Faisal University, Kingdom of Saudi Arabia. The goal of the study is to uncover the extent of the students' awareness of the international scientific publishing issues. The study results revealed that the majority of the respondents who participated in the study (52% - 75%) do not have sufficient awareness of the international scientific publishing vessels, insufficient awareness of the indexed scientific journals' quality standards, insufficient awareness of the features of the unindexed journals and the predatory publishing houses, insufficient awareness of the scientific journals' Digital Object Identifier (DOI) and their nominal status, in addition to the lack of awareness of the tools available that help researchers determine the appropriate and trusted journals, and insufficient awareness of the reasons for refusing to publish research in the scientific journal.

Although graduate students conduct research, they may be feeling worried when attempting to publish their research internationally, as a process which requires a set of unique skills. The fact of the matter is that graduate students receive little training related to performing the most important task in their primary careers which is writing for publishing purposes, in addition to the constraint of the frequent lack of training that would help them achieve these goals (McClellan, 2017). This gap represents an important opportunity for the concerned academic library not only to increase its support for graduate students, but also to demonstrate its value in relation to scientific productivity.

Based on these findings, the study problem was identified in the existence of an urgent and persistent need to create an awareness program for the international scientific publishing literacy that takes into consideration the conditions of social distancing imposed by Covid-19 pandemic instead of the physical attendance of graduate students in face-to-face training rooms in the campus of central library through using infographics, a newsletter through social media platforms, and email lists for graduate students in humanities.

The study provided a scientific contribution on this phenomenon through answering the following questions:

- Q1:** What is the effect of using infographics on developing the literacy of international scientific publishing among graduate students in humanities at IAU?
- Q2:** To what extent graduate students in humanities at IAU are satisfied with using infographics as a method to support scholarly communication within the academic library awareness programs?

The study aims to:

1. Design an awareness program about the literacy of scientific publishing in indexed journals using infographics.
2. Investigate the effect of using infographics on providing graduate students with the international scientific publishing literacy.
3. Measure the extent of graduate students' satisfaction with the use of infographics as a method to support scholarly communication.

The important of this study is represented in studying the effective uses of infographic technology in libraries and information centers, and the role of the academic library in raising awareness of international scientific publishing literacy, while its practical significance is embodied in trying to increase international publishing rates among graduate students at the university.

3. The theoretical framework

3.1. Infographics: its concept, characteristics, types, and its uses in libraries and information centers.

Infographics' concept and the information processing theory:

The term "Infographics" is an acronym for the phrase "information graphics", a popular visual technique concerned with visualizing information by using illustrations to present dense and abstract information, simplify the intended meaning and make it understandable to the audience. "Infographics" is defined as a visual image in the form of graphs or diagrams for the purpose of representing information or data and convey facts in a faster and clearer manner.

For humans, visual information are considered the most effective form of communication. According to (Dur, 2014; Lee, et. Al., 2020), the use of "infographics" as a means of information visual display stems from one of the most important theories which is "information processing theory" or "the cognitive information processing theory", which focuses on how an individual pays attention to the environmental events surrounding them, and their coding of information which they can learn and link with knowledge which is already existing in the memory, and how to store new knowledge and recall it when needed. The "information processing theory" emphasizes that the visual stimuli that people are exposed to provide them with the required awareness and understanding in an effective and greatly beneficial way to store information in long-term memory compared to other information which are not acquired through a visual method. Thus, the visual presentation provided through the "infographics" contributes to the improvement of perception and retention of information through providing the brain with easy tools and methods (visual elements and images) that are specifically designed to enable the brain to decode various forms of data and images, and thus integrating them into long-term memory, and improving the ability to quickly recall information.

Experimental research based on “the cognitive information processing theory” has resulted in setting a number of foundations and principles that information designers should take into consideration (Krum, 2013), including:

- The vision is the most powerful form of input that an individual uses to perceive the world around him. Vision is considered by far the most dominant sense in the human brain, and it consumes about half of the brain's resources. Studies estimate that between 50-80% of the human brain is devoted to forms of visual processing, such as vision, visual memory, colors, shapes, movement, patterns, spatial awareness, and image recall.
- A simple text message which is associated with an image can create an impression that lasts longer for the audience. When we read a text only, we remember about 10% of the information contained in it after three days; however, if this information is presented in the form of a text accompanied by image, we are likely to remember about 65% of this textual information accompanied by images and drawings after three days.

Types of infographics and tools of its design and production:

The design of infographics comes in more than one type according to its purpose; Infographics vary also according to form and layout, as well as the presentation method. In terms of form and layout, the infographics are classified into: Timeline, Versus, Flowchart, Photo Infographics, beside others such as Maps, Relations, Ideas, Hierarchy, and Statical Infographics. In terms of presentation, the infographics are divided into two types: Static Infographic and Motion Infographic.

Regarding the production of infographics, there is a wide range of websites that allow their users to design and produce professional and appealing infographics. These websites enable users to create a free account that provides access some ready-made templates that are used to create the required content using easy tools in a drag-and-drop method to produce downloadable infographics in forms of files for printing or sharing. The user also is provided with a large library of ready-made templates and forms for a small monthly fee under an Educational Account. Examples of these websites include Piktochart.com, Easel.ly.com, and Infogr.am.com; and all of them provide easy-to-use tools for the purpose of creating professional and attractive infographics, for which the user does not need specialized programs or high skills to design and create appealing and professional ones. (Wright, 2016)

Effective uses of infographics in libraries and information centers:

The literature in the field of libraries indicates that there is several uses of infographics (Ray Chaudhury, 2019; Yuvaraj, 2017; Chen, 2017; Wright, 2016), including:

Communicating the library message: Infographics are used to convey the library message to the beneficiaries in an interesting and appealing manner.

Promoting the library's events and activities: Infographics play an important role in promoting the library's events, activities, and displaying its services.

Displaying usage statistics: This includes the statistics of the library's usage frequency, electronic resource usage percentage, or service statistics for responding to electronic inquiries, or sharing data for the library's annual report, or other statistics on all of the library's activities.

Marketing the library's services: Many public, academic, and school libraries, as well as publishers use infographics as a tool to promote their mission, introduce the library's services, resources, and various activities, create interactive maps for the library, and market their products and services. In addition, they can be also used as tools for teaching, explaining, and sharing information.

Spreading the literacy and raising awareness of various issues: Many organizations with educational missions such as libraries, institutional information centers, and public health organizations are using the infographics as a means of informing their target audiences of organizational achievements or a research results summary, in addition to using it as a means of providing general awareness information for large groups of the web readers.

Although this literature review is not comprehensive, the results listed provide evidence of infographics' effectiveness in conveying information, increasing understanding and awareness, and enhancing the recall of the key pictorial information. German et al., (2020) used infographics in one of the major universities in Philippines as a method to raise the students' awareness of the cognitive aspects of the integrated management systems policy of the work environment; the results revealed that the students who participated in the study became more aware and more acquainted with the integrated management systems policy and became more knowledgeable in its content. The infographic charts used in social media posts and the notice board posters were clear, understandable, and included enough information which made them an effective method that has led to a positive enhancement of awareness, in addition to increasing attention and information retention in the memory of the students who participated in the study. In another study Prandi et al., (2020), a group of environmental experts and researchers designed instructional infographics in two styles (animated, aesthetic), and assessed its effect and ability to enhance awareness among university students. Also, the results of the study of Sharudin et al., (2020) revealed the importance of using infographics in increasing health awareness among youth and revealed also that infographics do not only attract the attention of the public, but also reinforce the conveyed message. In addition, the study of Jones et al., (2019) found that using infographics by students in three different universities on group work projects has improved their participation, learning, and provided them with opportunities of creativity and decision-making.

In light of these uses of infographics, especially its use in the academic library, the current study seeks to investigate the effect of using infographics on developing the international scientific publishing literacy among graduate students in humanities, and the extent of their satisfaction with its use.

3.2. Scientific publishing Literacy

Jeffrey Beall (2012) has formulated the term “Scientific publishing Literacy” to refer to the knowledge and skills required in the field of scientific publishing in open access journals, and defined the scientific publishing literacy as: “the ability to understand publishing methods, and to distinguish between trusted and predatory publishing journals”; Beall, (2012) has identified a set of knowledge and skills required to raise awareness of the scientific publishing literacy and avoid the predatory publishing, including the following: Researchers' understanding of journals in their specialty or major, journals indexing, the types of research they are publishing and the subfields of the specialization, experience in choosing the publishing vessels relating to the research and knowledge of publishing trends in these publishing vessels, awareness of the different methods of publishing in open access journals and their effects, familiarity with the publishing processes in open access journals, knowledge of copyrights and licenses including the Creative Commons license, knowledge of the scientific journal's key quality indicators and the ability to apply them when choosing the publishing vessel, in addition to acquiring the skills of using digital media to disseminate and deliver research results in a digital environment.

Grgic, (2016) presented a number of basic skills that the researcher must be familiar with in order to acquire the international publishing literacy, including: knowing how to find information in open sources, understanding open source verification methods, understanding the advantage of citing from open sources, evaluating open source repositories, evaluating open access journals, detecting and avoiding suspicious journals and publishers, understanding copyright and licensing issues, understanding persistent digital identifiers (such as author IDs, search or source IDs), determining the different issues of the published research (for example, pre-publication, post-publication), understanding new formats for disseminating digital resources in the electronic environment such as 3D images or video materials.

Several studies have addressed measuring the awareness of faculty members and their attitudes towards publishing in open access journals. Rodriguez, (2014) has studied the awareness of faculty members for doctoral degrees in American universities and colleges and their perceptions of publishing in open access journals. Also, Shuva & Taisir, (2016) have examined the awareness of faculty members in a Bangladeshi university of open access journals and the extent of using them by the faculty members. Manchu & Vasudevan, (2018) have also conducted a study on the extent of awareness among researchers at Calicut University about publishing in open access journals. Another study conducted by Punyani & Deshpande, (2018) targeted measuring the awareness of a sample of faculty members of the College of Dentistry in Central and Southern India about the key concepts in authoring scholarly publications, while the study Sheikh, (2019) worked on measuring “Faculty awareness, use and attitudes towards scholarly open access: A Pakistani perspective”. The overall results of these studies indicated that there was a lack of awareness among their study

population about the international publishing issues. And this denotes that there is a need for further studies to investigate the appropriate method for developing the scientific publishing literacy among researchers and graduate students in the humanities.

3.3 Academic libraries and their role in raising awareness of the international scientific publishing literacy.

Academic libraries play a pivotal role in supporting research within universities and research centers. Thus, providing information literacy and research support are two indispensable constituents of the main services of the university library.

Habitually, the library's support has been concentrated around information discovery, developing groups, and information management. However, with the emergence of digital technologies, open access journals, and the emergence of global scholarly communities has brought about profound transformations in the area of scientific publishing. Naturally, these changes have had a major impact on researchers' need for information and their behavior in dealing with this information. Academic libraries play a key role in supporting scientific publishing and continue to play this pivotal role in response to these changes through providing scholarly communication support services, and a comprehensive reconsideration of the way they interact with researchers and their research processes, as well through introducing new services that meet the researchers' needs (Corrall et al., 2013).

There are increasing expectations for librarians specialized in communication jobs to increase their competencies in the field of scholarly communication to facilitate effective engagement of graduate students and to teach them about international scientific publishing issues and copyright, to make more informed decisions about choosing the appropriate publishing vessel, and to find appropriate ways to integrate these topics to make them acquire the scientific publishing literacy to ensure that its users acquire the competencies of scientific publishing in the indexed international journals (Berger, 2017; Memon, 2019).

In this context, the current study aims to study the effect of using infographics on developing the scientific publishing literacy in indexed journals among graduate students.

4. Materials and methodology

4.1. Study methodology: The study used the descriptive approach to study the extent of awareness of graduate students in the humanities at Imam Abdulrahman bin Faisal University about issues of scientific publishing in indexed scientific journals; also, the study used quasi-experimental designs for one group design with pre- and post-test after using an experiment to find out the effect of using infographics on developing awareness of the international scientific publishing literacy among the study population and the extent of their satisfaction with it (Mark & Reichardt, 2009).

4.2. Study variables and experimental design: The independent variable was represented in designing a program to raise awareness of international publishing issues using infographics, while the dependent variables are: 1) Developing awareness of the international scientific publishing issues; and 2) Satisfaction with the use of infographics. Figure (1) illustrates the research experimental design.

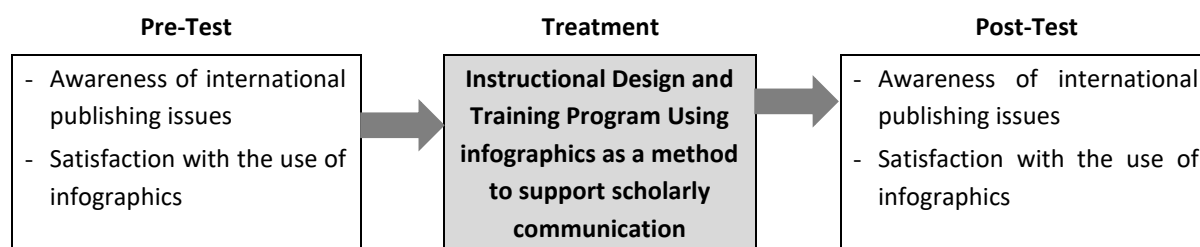


Figure (1): Research experimental design

4.3. Study hypotheses:

1. There are statistically significant differences at the p-value of (0.5) in the performance of graduate students on the scale of awareness of international scientific publishing issues before and after the use of infographics in the scholarly communication support program.
2. There are statistically significant differences at the p-value of (0.5) in the performance of graduate students on the scale of satisfaction with the use of infographics before and after the use of infographics in the scholarly communication support program.

4.4. Study population: The research population consisted of (314) male and female students in humanities who were enrolled in Arts Master and Doctoral studies at the Faculty of Arts, and the Master studies in Education, Faculty of Education at IAU. The awareness scale of scientific publishing issues and the scale of satisfaction with using infographics were distributed on the participants. (85) students, 27% of the study population, answered the questionnaires correctly. (59) male and female students in the humanities who responded to the study tools agreed on joining a program to raise awareness of the international scientific publishing literacy through using infographics via the social media “WhatsApp” created for this purpose. The respondents’ distribution is as shown in Table (1).

Table (1): Distribution of the Study Population

	Study Population			Pre-Test (No. Responses)	Treatment (No. of Responses)	Post-Test (No. of Responses)
	Gender		Total			
Faculty of Education	F	166	232	85 Students (27% of the Study Population)	59 Students	59 Students
	M	66				
Faculty of Art	F	42	47			
	M	5				

4.5. Tools of the study: In this study, a scale of awareness of international scientific publishing issues was built besides the scale of measuring satisfaction with using the infographics in scholarly communication support programs, as follows:

A. The scale of awareness of international scientific publishing issues:

The scale aims to investigate the extent of graduate students' awareness of international scientific publishing issues. The scale items included 36 phrases denoting 6 main issues, which are: 1. Awareness of scientific publishing vessels; 2. Awareness of the indexed scientific journals quality standards; 3. Awareness of the characteristics of unindexed journals and predatory publishing houses; 4. Awareness of the tools available on the internet that help researchers identify trusted journals; 5. Awareness of the digital object identifiers of scientific journals and their nominal value; and 6. Awareness of the reasons for refusing to publish the research in the scientific journal.

The scale was designed so that the degree of the study population' awareness could be measured by responding to the three-grade Likert scale as follows: **I am fully aware = (3) points; I am somewhat aware = (2) points; I do not have sufficient awareness = (1) point.** The points/ grades of the scale were evaluated as shown in Table (2), where the highest score of the awareness scale = 36 statements x 3 = 108 points, which expresses full awareness, and the lowest score = 36 words x 1 = 36 points, which expresses a very low awareness of the issues in question, as shown in Table (2).

Table (2): Calculating/ measuring the degree of awareness

Domain	Nu. of Items	level of awareness			High Score	Low Score
		Completely Awareness (3)	Some Extent Awareness (2)	Don't Have Awareness (1)		
Awareness of scientific publishing material	3				9	3
Awareness of scientific indexed journal quality standards	11				33	11
Awareness of unindexed scientific journals and predatory publishing	6				18	6
Awareness of available tools on the internet that help researchers and authors identify the appropriate and trusted journals	4				12	4
Awareness of digital object identifiers	5				15	5
Awareness of rejection reasons for publishing research studies in scientific indexed journals.	7				21	7
Total score for the Awareness Scale	36				108	36

The validity of the content of the scale was verified by presenting it to a group of referees who are specialized in the field of libraries and information to express their views; in light of their comments on the objectives and content of the scale, the proposed amendments were made specifically in what concerns the formulation of some phrases, merging some phrases, and deletions of some phrases. And this was considered as the validity of the questionnaire

content. Also, the stability of the questionnaire was calculated by calculating the alpha factor, which recorded (0.91), which in turn denotes a significance value of (0.05), indicating the stability of the scale and the reliability of the results derived from it (Appendix 1).

B. The scale of satisfaction with the use of infographics in the scholarly communication support program:

The scale aims to measure the satisfaction of the study population regarding the use of infographics in raising awareness of international scientific publishing issues. The scale items included 15 statements, which covered four main areas namely: technological satisfaction/comfort, satisfaction with the quality of content design, satisfaction with the method used to provide support, cooperation and participation, and overall satisfaction / or perceived benefit.

The scale was designed to measure the graduate students' satisfaction on a five-grade sliding scale as: Fully Satisfied = 5 points; Satisfied = 4 points; Neutral = 3 points; Somewhat Dissatisfied = 2 points; Not satisfied at all = 1 point. The grades of the scale were calculated as shown in Table (3) so that the maximum score of the satisfaction scale = 15 statements x 5 = 75 points, which expresses satisfaction to the fullest extent, and the lowest score = 15 statements x 1 = 15 points, which expresses an absolute dissatisfaction, as shown in Table (3).

Table (3): Calculating/ measuring satisfaction degree

Domain	Nu. of Items	level of satisfaction					High score	Low score
		(5)	(4)	(3)	(2)	(1)		
Technological Satisfaction	3						15	3
Satisfaction with the quality of content design	4						20	4
Satisfaction with the method used to provide support and scholarly communication	4						20	4
Overall satisfaction	4						20	4
Total score for the Satisfaction Scale	15						75	15

The validity of the scale's content was verified by presenting it to a group of referees who are specialized in the field of libraries and information to express their views; in light of their comments on the objectives and content of the scale, the proposed amendments were made specifically regarding the formulation of some phrases, merging of other phrases, and deletions of other ones. And this was considered as the validity of the questionnaire content. Also, the stability of the questionnaire was calculated by calculating the alpha factor, which recorded (0.87), which in turn denotes a significance value at (0.05), indicating the stability of the scale and the reliability of the results derived from it (Appendix 2).

4.6. Design and development of the research experiment

To investigate the effect of using infographics on developing the international scientific publishing literacy among the study population, a program has been designed and developed to raise awareness of the concepts and issues of international scientific publishing using infographics.

Many instructional systems design models used systematic approach to design and develop instructional materials for teaching information literacy. The systematic approach consists of instructional system design (ISD) models such as ADDIE, ASSURE, Dick and Carey model (Lamb, 2017, Davis, 2013). Most models include the same basic elements known as the ADDIE model. It is a systematic instructional design model consisting of five phases: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation, as main phases in the creation of instructional materials for teaching (Davis, 2013).

The researcher designed and developed an awareness program on scientific publishing concepts and issues using static Infographics “experimental treatment” by using (ADDIE) model as shown in the following Fig. (2):

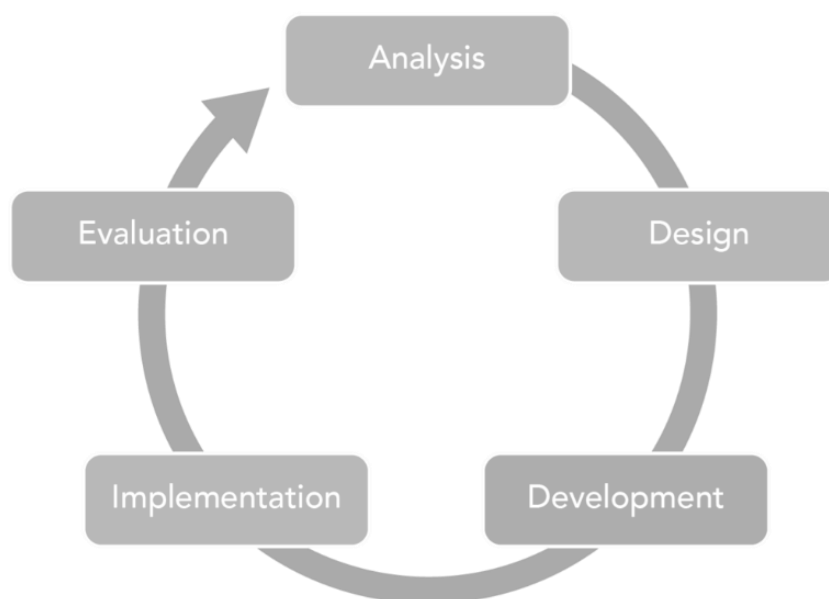


Fig. 2: ADDIE Model for Instructional Design and Training Program

Analysis phase: the following steps were taken:

Analysis of the problem and needs assessment: The problem was identified in the low level of awareness of international publishing issues in indexed scientific journals among graduate students in the humanities, and their needs were assessed to be dealt with through a program to develop the literacy of international scientific publishing that takes into consideration the use of remote training methods, given the circumstances of Covid-19 pandemic.

Goal identification: The overall goal was set in developing the literacy of international scientific publishing among graduate students in the field of humanities.

Learning outcomes: By the end of the training program, the participant will have been able to:

- a. Identify the scientific publishing vessels.
- b. Choose the indexed scientific journal according to its quality standards.
- c. know the characteristics of unindexed scientific journals and predatory publishing houses.
- d. Gain skills in dealing with tools namely Web of Science, Scopus, Scimago, uLrichs, JCR, and others to determine the appropriate and trusted journals.
- e. Identify the digital object identifiers for scientific journals and their nominal value, such as IF, DOI, ISSN, DOAJ, OASPA, h-index ... etc., and awareness of scientific journals rank (Q1, Q2, Q3, Q4).
- f. Analyze the reasons for refusing to publish the research in scientific journals.

Determining the content: The content of the infographic awareness program covered the following basic topics:

- Awareness of scientific publishing issues and its materials, such as the type of material submitted for publication, difference between subscription journals, e-journals, open access journals (OAJ), e-publishing, open access, and free online access.
- Awareness of quality standards of scientific indexed journals, such as institutional affiliation, indexing in the recognized databases, editorial board, and advisory board with an academic standing, journal impact factor, whether the journal has a private website and email, an online system for research submission, revision, and track research, the fees required are clear and specific, etc.
- Awareness of unindexed scientific journals and predatory publishing, such as missing information about the journal, not belonging to any known academic institution or publisher, not mentioned in the indexes of international standard journals, requires expensive financial fees, immediate approval to publish the submitted research without review or revision in a very short time, etc.
- Awareness of available tools on the internet that help researchers and authors identify the appropriate and trusted journals, such as Web of Science, Scopus, Scimago, uLrichs, and JCR, etc.
- Awareness of digital object identifiers, such as IF, DOI, ISSN, DOAJ, OASPA, h-index...etc., and awareness of scientific journals rank (Q1, Q2, Q3, Q4).
- Awareness of the concepts and variables relating to ethical issues in scientific publishing, such as plagiarism, ghost authorship, gift authorship, redundant authorship, multiple submission, previous publication, conflict of interest, etc.

- Awareness of rejection reasons for publishing research studies in scientific indexed journals, such as authorship criteria, manuscript organization, manuscript length, manuscript editing requirements, automated submission. etc.

Design phase: This stage includes designing the infographic content, and continuing its display, according to the following criteria:

- The infographic content is suitable for the target group.
- One infographic includes one idea that provides more value to the beneficiaries.
- Inclusion of attractive headlines for the infographic topic.
- The infographic design is simple, focused, and easy-to-view, so that there are no more than three points in a single infographic, to make the infographic content easy to remember.
- The good flow of information and its sequence using the technical design elements such as size, proximity, contrast, weight, style, color, uppercase versus lowercase, etc., to ensure the flow of the content message.
- Choosing no more than three colors and one font, so that the viewer's senses are not overwhelmed or disturbed.
- Including source data, information, and facts to confirm their validity.

Development phase: In this stage, the actual production of the infographics was carried out using the computer program “Adobe Illustrator”, which is the appropriate program for creating graphics, illustrations, and digital printing of all types of media, both printed and published on the web. Through this program, 30 static infographics were created to address the issues under study.

Implementation phase: At this stage, the awareness program for the international scientific publishing literacy was implemented during six academic weeks in the first semester of the academic year 2020/2021. Each issue’s infographic was brought into discussion through the social media platform “WhatsApp” as Covid 19 pandemic imposed the remote online communication.

Evaluation phase: At this stage, a process of continuous evaluation of the awareness program based on the employment of infographics was carried out through a survey directed to three faculty members specializing in libraries and information who viewed the content of the infographics, and presented their views on the adequacy of the content specified for the issue under discussion, and the extent to which the design standards are respected, and its suitability for the purpose for which the awareness program was prepared. The remarks of the referees were taken into consideration, and the necessary adjustments were made, so the educational content of the awareness program using infographics is finalized and suitable for the purpose of the current study. Also, the final evaluation process for the awareness program was conducted through the post application of measurement tools: 1. Awareness of scientific publishing issues, and 2. Satisfaction with the use of infographics in

scholarly communication support programs, in order to verify the effect of using infographics in raising awareness of the of international scientific publishing literacy.

4.7. Statistical processing of data.

The data were statistically processed using SPSS version 24 software, and appropriate statistical methods were implemented for data analysis, namely "Cronbach's alpha" parameter to calculate the stability of measurement tools; Arithmetic means and standard deviations are considered a descriptive statistic of data expressing the responses of the study population. Paired samples T-test was used to calculate the significance of the differences between the averages of the study population's responses to identify awareness of scientific publishing issues before and after using infographics in scholarly communication support programs.

5. Results of the study

5.1. Regarding the effect of using infographics on developing the international scientific publishing literacy.

Arithmetic averages and standard deviations were calculated for graduate students' scores on the awareness scale of international scientific publishing issues, before and after the use of infographics in the scholarly communication support program. Then the significance of the differences between the averages was calculated using the T-Test for correlated samples. The results were as presented in the following Table (4) and Figure (3):

Table (4): Arithmetic averages, standard deviations, and the significance of the differences between the averages of the pre- and post-measurement scores for the performance of the study population on the awareness scale of international scientific publishing issues

Item Awareness of:	Pre-test		Post-test		df	t	Sig. (2-tailed)	Effect Sizes (Cohen's d)
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>				
scientific publishing material	4.64	1.04	8.59	0.64	58	27.07	0.000	1.12
Quality standards of scientific indexed journal	18.03	1.96	30.63	1.36	58	37.68	0.000	2.57
Unindexed journals and predatory publishing	9.58	1.75	16.58	1.07	58	27.73	0.000	1.94
Available tools on the internet that help researchers and authors identify the appropriate and trusted journals	6.31	1.12	10.44	1.16	58	21.47	0.000	1.48
Digital object identifiers	7.90	1.53	12.97	0.91	58	20.97	0.000	1.86
Rejection reasons for publishing research studies in scientific indexed journals	11.44	1.12	18.75	1.56	58	28.14	0.000	1.99
Overall average for the Awareness Scale	54.80	3.46	97.94	2.85	58	86.11	0.000	3.84

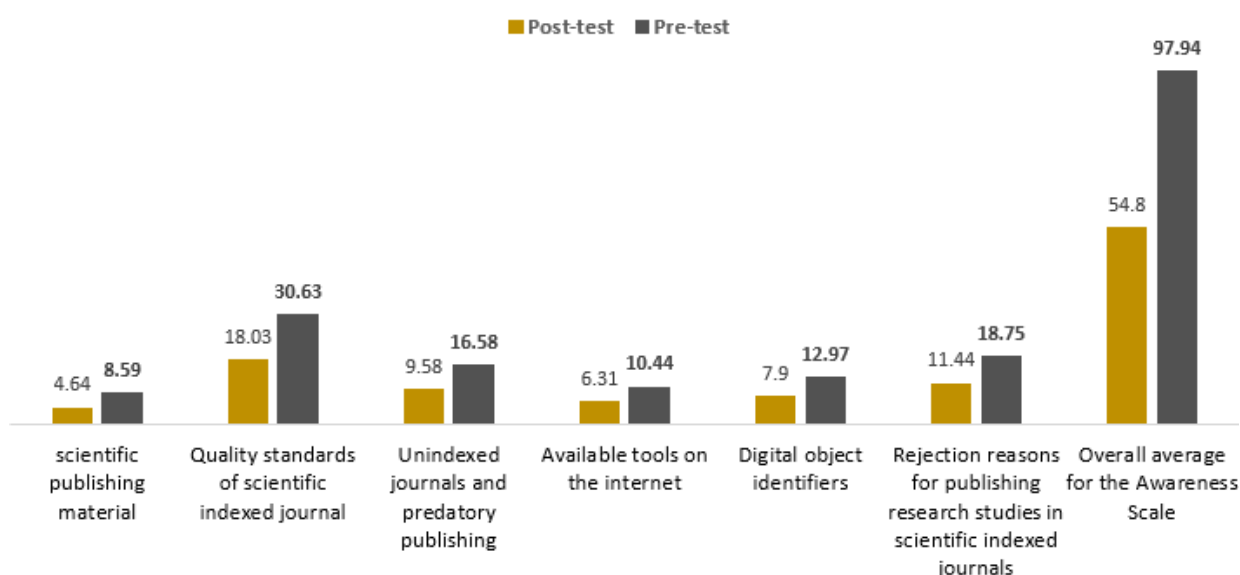


Fig (3): Arithmetic averages of graduate students' performance in pre- and post-measurement on the awareness scale of international scientific publishing issues

The results shown in Table (4) and Fig. (3) above show that there is a statistically significant difference at the level (0.01) between the pre- and post-measurement scores for the performance of graduate students on the scale of awareness of international scientific publishing issues in favor of the post-measurement performance; and these differences are due to the effect of using infographics in scholarly communication support program among students. This means that the first hypothesis *"There are statistically significant differences at a significant level of (0.5) in the performance of graduate students on the scale of awareness of international publishing issues before and after the use of infographics"* is accepted. Also, the effect size for the correlated samples was calculated by calculating Cohen's d (Cohen, 1988), and all values were greater than 0.08, which means that there is a large effect size for the use of infographics in the development of the international scientific publishing literacy among graduate students.

5.2 Regarding the satisfaction of graduate students -the study population- with using infographics in the scholarly communication support program.

Arithmetic averages and standard deviations were calculated for graduate students' scores on the scale of satisfaction with using infographics in scholarly communication support programs, before and after the use of infographics; and then the significance of the differences between the averages was calculated using the T-Test for the correlated samples, as shown in the following Table (5) and Fig. (4):

Table (5): The arithmetic averages, standard deviations, and the significance of the differences between the averages of the pre- and post-measurement scores of the performance of the study population on the scale of satisfaction with using infographics in scholarly communication support programs

Item	Pre-test		Post-test		df	t	Sig. (2-tailed)	Effect Sizes (Cohen's d)
	Mean	SD	Mean	SD				
Technological Satisfaction	6.57	1.21	14.41	0.83	58	44.42	0.000	1.35
Satisfaction with the quality of content design	8.81	1.42	18.86	1.24	58	43.48	0.000	1.78
Satisfaction with the method used to provide support and scholarly communication	8.30	2.05	19.00	0.93	58	36.45	0.000	2.25
Overall satisfaction	8.34	1.72	18.74	1.36	58	35.49	0.000	2.25
Total score for the Satisfaction Scale	25.83	2.73	71.02	2.28	58	96.33	0.000	3.60

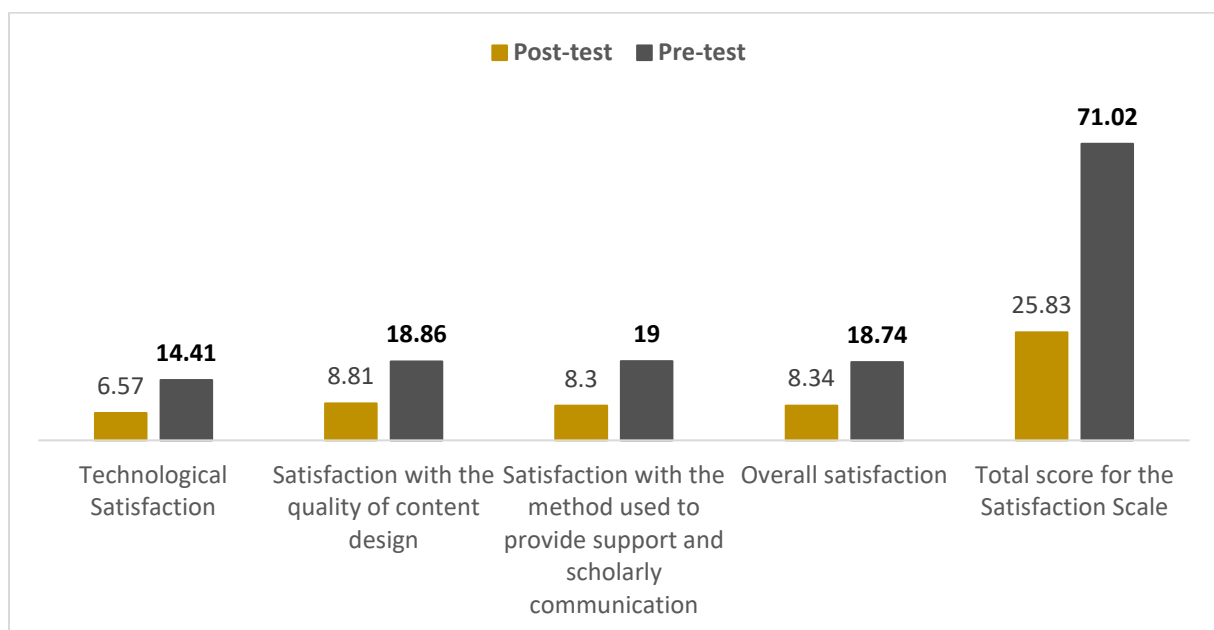


Fig (4): Arithmetic averages of graduate students' performance in pre- and post-measurement on the scale of satisfaction with using infographics in scholarly communication support programs

The results shown in Table (5) and Fig. (4) above indicate the existence of a statistically significant difference at the level (0.01) between the pre- and post-measurement scores for the performance of graduate students on the scale of awareness of international scientific publishing issues in favor of the post-measurement performance; and these differences are due to the effect of the use of infographics in scholarly communication support programs among students. This means that the second hypothesis *“There are statistically significant differences at a significant level of (0.5) in the performance of graduate students on the scale of satisfaction with the use of infographics in the scholarly communication support program, before and after the use of infographics, in favor of post-measurement”* is accepted. Also, the effect size was calculated by calculating Cohen's d (Cohen, 1988), and all values were greater than 0.8, which means that there is a large effect of the use of infographics in the development of the international scientific publishing literacy among graduate students.

6. Discussion and interpretation of results

The results of the study revealed that there is a statistically significant difference at the level (0.01) between the pre- and post-measurement scores of the performance of graduate students on the scale of awareness of international scientific publishing issues, and the scale of satisfaction with the use of infographics in favor of the post-measurement performance, which means that there is an effect of the use of infographics in the scholarly communication support program on developing awareness of international scientific publishing issues, as well as effect on satisfaction with using infographics among graduate students; and these differences were of large effect size. These results are explained by the motivating characteristics and features of the infographics, making it an effective way to raise awareness of the issues of international scientific publishing, and achieving high levels of satisfaction among the participants, as the infographics contributed to the following:

- ***Reducing the information overload:*** This is because the information overload represents a source of stress and an obvious impediment to processing information, because it is directly related to the ability of individuals to store and process information. Information overload has a strapping influence on human behavior when recalling and processing information. Individuals have limited mental capacity regarding the amount of information that they can assimilate and process at a given time; and when the information is not presented to the audience in an easy way, the increased information may weaken the significance of important information related to what the target audience (reader, viewer, etc.) is expected to be aware of (Lee et al., 2020).
- ***Simplifying complex information and speeding up its processing:*** Infographics, as visual stimuli, are a fast way to simplify complex information and facilitate its understanding. The information we share with our target audience may be dense, confusing, or may carry different views or interests. Infographics work on humanizing data by focusing attention on important information with distinctive elements such as color, images, and graphics, which contributes to understanding the message and increasing retention. The ability to visually communicate a point of view is the best strategy when we have a large audience, so seeing and processing information visually is a sort of relief (Yuvaraj, 2017). In general, individuals prefer image-based information and pictorial elements such as infographics and graphs over textual information, as they can process the information contained therein more easily and accurately compared to the textual information and written pages.
- ***Attracting the attention of the audience:*** Infographics are an effective way to attract and hold attention during the process of visual communication, by converting information and data from numbers, letters, and words into dense interesting images, drawings, and information that contribute to attracting the attention of the audience (readers / viewers) and expand the reading of the text. The general use of visual cues in texts acts as an entry point for readers, which makes them more interested in the content (De Haan et al., 2018).

- ***Ease of displaying and sharing information:*** The infographics are presented as a picture or digital file; thus, they transfer information to others of different cultures and languages easily and share it with them through many social media platforms or websites, which allows transferring knowledge in fast-spreading ways to reach a larger targeted audience (Jones et al., 2019).
- ***Shareability:*** Infographic designs are produced in the form of digital content, making it easy to share across different electronic content platforms, while it allows its readers as well to learn in a collaborative way, and supports communication between them. In addition, it is copyright-sensitive thus making the content more secure and more protected while being shared (Davis & Quinn, 2013). This contributed to achieving satisfaction with the use of infographics as a modern technology that facilitates academic communication between junior researchers in the field of international publishing.

On the other hand, the results of the current study agree with the results revealed in previous studies. The infographic charts used in social media posts and notice board posters were clear, understandable, and included with sufficient information that made them an effective means that led to a positive enhancement of awareness of integrated management systems for the work environment among Filipino university students (German et al., 2020), and that the infographics have an effect on enhancing environmental awareness among university students (Prandi et al., 2020), and demonstrating an effect on increasing health awareness among young people (Sharudin et al., 2020), improving university students' participation and learning, and providing them with the opportunity for creativity and decision-making within group action projects (Jones et al., 2019).

7. Conclusion

The results of this study revealed that the training content materials which are appropriately designed using infographics and using the WhatsApp platform to support scholarly communication can contribute to increasing the awareness of graduate students and junior researchers about the concepts and issues of international scientific publishing and increase their satisfaction with it. In light of the results of this current research and the results of the previous studies, we present a set of recommendations and suggestions as follows:

1. It is recommended to include the infographics technology in teaching information literacy programs provided by the academic library to create an educational and training environment that attracts the attention of the participants, increases learning opportunities, and extends information retention for a longer period.
2. Giving due care to the quality of the visual design elements and achieving its standards and principles in all electronic presentations made by the academic library within its activities and awareness campaigns.
3. Including a course of the "International Scientific publishing Literacy" within the study plans for higher education programs, which contributes to providing junior researchers with scientific publishing literacy and its various issues and tools.

In addition, the researcher also suggests conducting a study to investigate and know which types of infographic content (relations - lists - deductive - inquiry) are most effective in improving the learning outcomes of participants in the awareness programs offered by the academic library. This is besides conducting more experimental research to measure the effectiveness of using infographics within the scholarly communication support programs provided by the academic library in developing the international scientific publishing literacy among the university's faculty members to publish in indexed journals.

Acknowledgements

The author is grateful to the participants of the survey and thank the reviewers for their enriching comments to improve the article.

No grant from any public, commercial, or non-profit funding agency was offered for the conduct of this research.

Declaration of interest statement

The author declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Appendix (1):

Satisfaction Scale with the use of infographics in the scholarly communication support program

Scale Instructions

The scale aims to measure the satisfaction of the study population regarding the use of infographics in raising awareness of international scientific publishing issues. The scale items included 15 statements, which covered four main areas namely: technological satisfaction/comfort, satisfaction with the quality of content design, satisfaction with the method used to provide support, cooperation and participation, and overall satisfaction / or perceived benefit.

The scale was designed to measure the graduate students' satisfaction on a five-grade sliding scale as: Fully Satisfied = 5 points; Satisfied = 4 points; Neutral = 3 points; Somewhat Dissatisfied = 2 points; Not satisfied at all = 1 point.

Scale items:

Domain	Nu. of Items	level of satisfaction				
		(5)	(4)	(3)	(2)	(1)
Technological Satisfaction	1. Reviewing the infographic is technically easy.					
	2. It is easy to store infographics and share them with colleagues.					
	3. The infographic display platform allowed me to easily and conveniently communicate with my colleagues.					
Satisfaction with the quality of content design	1. The infographic content is structured, clear, informative; and the visual representation of the information contributed to the simplification and understanding of complex information.					
	2. Infographic content is available at any time.					
	3. The quality of information and its relevance in the infographic					
	4. The content is sufficient for awareness of the issue in question.					
Satisfaction with the method used to provide support and	1. Sharing ideas with colleagues about the infographic content contributed to gaining more knowledge of international scientific publishing issues					

scholarly communication	2. Infographics provided effective sharing of content with my colleagues on social media platforms.					
	3. Colleagues' comments during the infographic presentation provided meaningful and continuous feedback					
	4. I was pleased to exchange ideas and visions with my colleagues on the issues addressed by the infographic.					
Overall satisfaction	1. Infographics helped me increase attention, focus and information retention.					
	2. I am very satisfied with the use of infographics to raise awareness of the issues under discussion.					
	3. Infographic technology as a new way of presenting summary information in the online training environment fulfilled my expectations, and I enjoyed it very much.					
	4. I suggest using infographics in awareness programs for academic library services - especially in light of the lack of face-to-face training opportunities due to the "covid 19 pandemic" -.					

Appendix (2):

Awareness scale of international scientific publishing issues

Scale Instructions

The scale aims to investigate the extent of graduate students' awareness of international scientific publishing issues. The scale items included 36 phrases denoting 6 main issues.

The scale was designed so that the degree of the study population' awareness could be measured by responding to the three-grade Likert scale as follows: I am fully aware = (3) points; I am somewhat aware = (2) points; I do not have sufficient awareness = (1) point.

Scale items:

Domain	Nu. of Items	level of awareness		
		Completely Awareness (3)	Some Extent Awareness (2)	Don't Have Awareness (1)
Awareness of scientific publishing material	The type of material submitted for publication; and the difference between a peer-reviewed and non-peer-reviewed journal			
	Difference between subscription journals E- journals; open access journals (OAJ);			
	e-Publishing, Open Access, Free Online Access			
Awareness of scientific indexed journal quality standards	The journal's aims & scope are clear and specific			
	institutional affiliation			
	indexed in the recognized databases,			
	Editorial board, and advisory board with an academic standing,			
	High Impact factor for Journal issued by "Thomson Reuters"			
	The journal has an ISSN number, a DOI digital ID, and membership in OASPA or DOAJ in case the journal is open source.			
	has a private website and email			
	an online system to Submit revise, and track research			
	The journal uses specialized software and websites to examine scientific plagiarism before starting its peer review process			
	Time to review and publish is limited			
	the fees required are clear and specific			
Awareness of unindexed scientific journals and predatory publishing	Information about the journal is missing,			
	Journal does not belong to any known academic institution or publisher			
	journal is' not mentioned in the indexes of international standard journals			
	Journal does not have an editorial board or advisory board of academic standing			
	Journal requires expensive financial fees			
	Immediate approval to publish the submitted research without review or review in a very short time			

Awareness of available tools on the internet that help researchers and authors identify the appropriate and trusted journals	Web of Science			
	Scopus			
	The Science Citation Index			
	Journal Citation Reports (JCR)			
Awareness of digital object identifiers	IF, DOI, ISSN, DOAJ, OASPA, h-index...etc.)			
	Methods for calculating journal impact factor			
	journal DOI			
	researcher digital ID "ORCID"			
	Scientific Journals Rank (Q1, Q2, Q3, Q4)			
Awareness of rejection reasons for publishing research studies in scientific indexed journals.	Authorship criteria			
	Manuscript structure			
	Manuscript length			
	Editing manuscript requirements			
	Automated submission system			
	Multiple submission			
	Previous publication			